Forage News
Mississippi State University Extension Service

Grazing and Feeding Practices under Contrasting Cold Temperatures

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Early vigorous growth in fall and late maturity has made annual ryegrass a popular forage crop. In Mississippi, approximately 40 to 50% of the warm-season pastures are planted on annual ryegrass to minimize winter feeding. Climatic conditions such as temperature and precipitation play a major role in determining biomass production. Annual ryegrass is best adapted to cool, moist climates, but not to temperatures below 30 ºF. Best growth occurs between 50 and 70°F. Thus, annual ryegrass grows well in early spring and fall. Although annual ryegrass is tolerant to cold weather, temperature stress causes winter production to suffer even if adequate water and fertilizer is available.

Growing Degree Days (GDD)

Since temperature is a major regulator of growth and development, biomass production is as a function of accumulated growing degree days (GDD). The time required for ryegrass to recover from extreme cold temperatures varies with location and it is very dependent on the amount of heat experienced by the plants. The frequency of cold temperatures will determine the recovery time. GDD is used to calculate the amount of heat received. It is calculated as the daily average temperature (Max + Min/2) minus the base temperature of 50 ^{o}F at which ryegrass growth slows down considerably. For example, if the average high temperature for the last 15 days has been 36 ºF and the low has been 20 ^{o}F, the GDD = ((36 + 20)/2) - 50 = **- 22**. That means that annual ryegrass growth has been delayed considerably for the past three weeks since at least 10 GDD is needed for growth. This type of climatic condition will directly affect the rate of leaf appearance and development since they are primarily controlled by temperature or GDD.

Fertilization Strategies

Yield responses to N fertilization are greatest if the N is applied and available at the time the crop makes its most rapid growth. When average temperatures drop below 50 degrees, plant processes begin to slow down and growth is reduced. It is important to understand that under below normal cold conditions, plants expend more energy and partition more biomass to their roots and less to their shoots. Under stress conditions, this results in lower tiller number per unit area to utilize high rates of applied N.

Under the adverse cold weather conditions that Mississippi has experienced in the last couple of weeks, nitrogen applications to annual ryegrass should be delayed until temperatures has reach at least 50 ºF for 3 to 5 days to ensure the nitrogen is used by the annual forage. Also, it is advisable to delay grazing for at least two weeks after N application in order to speed up plant recovery. This will allow for nutrient translocation and development of new roots as the weather returns to moderate, normal temperatures. Keep in mind that applying high N rates to annual ryegrass might not be beneficial because utilization might not be optimum and economic losses could occur. Small split applications might be more beneficial under this type of stressful condition.

Grazing Pressure

Stocking rate is a critical factor in the success of winter annual pastures. Under cold conditions, producers should take into consideration that stocking rate will vary more heavily due to the lower productivity of the pasture and the amount of nitrogen utilized by the plant. Winter annual foliage (both ryegrass and annual clovers) may burn during severe cold spells and, therefore, tends to be lost if not grazed. Low temperatures and excessively rainy periods and cloudy days all contribute to periods of slow grass growth over which producers have no control. If your stocking rate is too high during periods of slow (or dormant) grass growth, overgrazing will decrease the ability of the grass to recover during favorable periods and shorten the length of the grazing cycle (less days of forage availability). Under rotation, cattle should be moved to a new paddock quicker than usual to avoid overgrazing and a canopy height of 5 to 7 inches (instead of the 3 to 4 inches usually recommended) should be maintained until plants have completely recovered from severe cold temperatures.

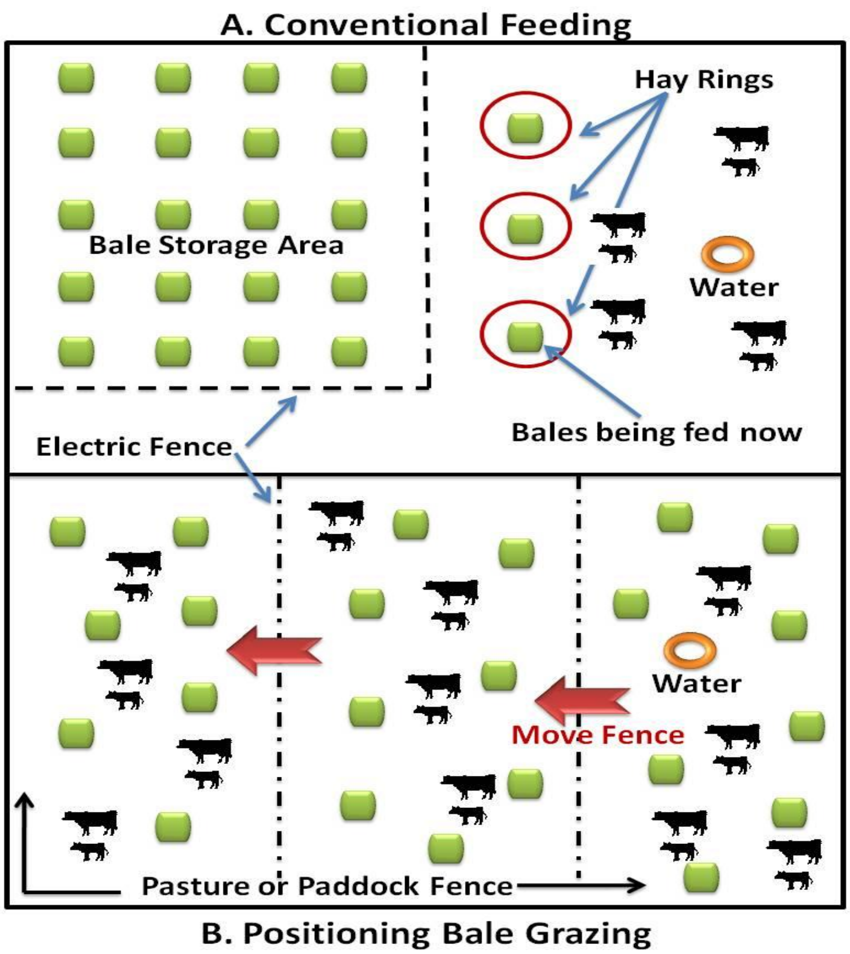

Figure 1. Comparison of (A) “Conventional Feeding” and (B) “Positioning Bale Feeding”.

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This year annual ryegrass forage production has been limited by cold temperatures. While this stress alone is capable of causing plant death, it is most commonly their interaction with defoliation stress that leads to a decline in pasture productivity and the introgression of a decline in the grazing cycle. Annual ryegrass injured by low temperatures is more susceptible to damage by livestock trampling and this damage can be either temporary or permanent. Therefore, livestock should be kept off ryegrass until recovery has occurred and growth has resumed. Because of these conditions, producers should be ready to supplement animals with hay or grain in order to decrease grazing pressure on the pasture until it can fully recover.

Adjusting Hay Feeding Strategies

Low temperatures have left cattle producers scrambling for hay and winter feed supply. One of the strategies when feeding hay is to maximize utilization. Most hay producers in MS usually leave their hay standing in the field, giving them the opportunity for utilizing a system called "Positioning Bale Grazing." This approach works by fencing narrow strips where the bales had been previously placed with electric fences (**Fig. 1**). It is recommended having approximately the same number of bales in each strip to maintain a constant rotation. Always calculate the daily forage consumption of the livestock class to determine the number of bales needed for a specific grazing period (days). The amount of feeding labor is reduced by just moving the electric fence back and exposing the next set of bales. This is a very similar process to the strip-grazing technique. This approach will allow livestock to utilize hay that has been exposed to the environment more quickly and reduce storage and quality loses. By using this system instead of feeding hay in one place, livestock can also provide better nutrient distribution (especially manure) back into the pastures.

Table 1. Changes in daily dry matter intake (DDMI) when affected by temperature.

Temperature (^{o}F)	Intake (% Change)
<5	1.16
5 to 22	1.07
22 to 41	1.05
41 to 59	1.03
59 to 77	1.02
77 to 95	0.90
>95	0.65

Source: Boyles and McCutcheon. 2009. Winter Cold Stress on Cattle. The Ohio State University.

Colder weather slows growth of winter pastures forcing livestock producers to increase supplemental feeding. Experienced livestock producers are well aware of the toll low temperatures can have on animal health and performance. As the temperatures begin to fall in the early winter months, livestock require additional energy to stay warm (**Table 1**). This additional energy requirement usually calls for changes or alterations in feeding practices. Under cold conditions, livestock require additional energy to maintain their internal body temperatures and keep warm. The exact amount of energy depends on the severity and extent of the cold period. It is important to know the quality of the hay being fed as well as the livestock body score condition (BCS).

Table 2. Estimated lower critical temperatures for livestock.

Livestock Class	Coat Description	Lower Critical Temperature[1,2]
Beef Cattle	Wet or summer coat	60°F
	Dry fall coat	45°F
	Dry winter coat	32°F
	Dry heavy winter coat	19°F
Horses	Dry heavy winter coat	15°F
	Dry winter coat	45°F

[1] The lower critical temperature is defined as the effective ambient temperature at which energy intake must increase in order to minimize reduction in weight gain or to prevent weight loss in mature livestock.
[2] Critical temperatures depending largely on hair coat length and hair coat condition (dry, wet, muddy, etc.).
Sources: Boyles and McCutcheon. 2009. Winter Cold Stress on Cattle. The Ohio State University; Anonymous. 2009. Cold Weather Feeding Practices for Horses. eXtension.

When environmental temperatures drop below the critical livestock temperature (**Table 2**), significant amounts of energy are used by livestock to maintain their internal body heat. It has been estimated that for each 1 °F decrease below the critical temperature, livestock might require a 1% increase in the livestock energy requirement [total digestible energy (TDN)] to maintain a consistent body temperature. It is also estimated that for every ten degrees below the critical temperature, the digestibility of the ration decreases by 1 percent. This means that when the temperature drops below the critical temperature, the cattle need to be fed better (**Table 3**). It may be that more or higher quality hay needs to be fed. Moreover, drier hay (compared to pasture) has a lower rate of passage, thereby staying in the rumen longer, which allows for more prolonged digestion and heat generation from that process. Provide minerals at all times for the cattle based on requirements for your area. Forages may provide the energy and protein that a cow needs, but they are almost always deficient in one or more minerals. Water should be available at all times, easily accessible, and kept free of ice cover. Restricted water consumption will decrease the intake and digestibility of feed. Provide windbreaks and shelters to reduce wind speed.

During prolonged periods of cold temperature (several days to weeks) below the critical temperature, both the supplemental feed and the forage portion of the diet should increase in equal portions. Feeding additional amounts of supplemental feed or increasing the energy density of the supplemental feed is especially important if the livestock has poor body condition. For beef cattle accustomed to a high roughage diet, the amount of energy change should be made gradually to avoid rapid changes in the rumen microbial population and to avoid severe digestive disorders such as acidosis. A second commonly used approach is to reserve the highest quality hay for feeding during cold weather periods.

Table 3. Increase in energy and feed supply needs for beef cattle when affected by changes in temperature.

	Additional Supplementation Needed		
Temperature (°F)	**TDN[1]**	**Hay**	**Grain**
	(%)	**---------------- (lbs/cow/day) ----------------**	
50	0	0	0
+30	0	0	0
10	20	3.5 to 4.0	2.0 to 2.5
-10	40	7.0 to 8.0	4.0 to 6.0

[1]TDN = Total Digestible Nutrients.
Source: Boyles and McCutcheon. 2009. Winter Cold Stress on Cattle. The Ohio State University.

Summary

Low temperatures in the winter could have a great impact in livestock production systems (both grazing patterns and hay/feed supplementation). Producers implementing management strategies to cope with this type of uncontrollable environmental condition could be very successful at reducing their livestock wintering costs. It will be helpful to monitor weather forecasts to determine cold periods in advance and be able to increase the dry matter content of the diet and to adjust the digestible energy accordingly. I know what some of you are thinking right now: "This guy is crazy." Use the information discussed above to your benefit; observe when pastures can be grazed and when and where hay should be fed. Instead of making a drastic transition under cold weather stress, implement the information provided above to achieve feeding goals most effectively.